Poverty Traps and Safety Nets

Christopher B. Barrett
Department of Applied Economics and Management
Cornell University

and

John G. McPeak
Maxwell School of Citizenship and Public Affairs
Syracuse University

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Poverty Traps and Safety Nets

Erik Thorbecke has been a leader among development economists for decades and an inspiration to those of us who have had the privilege to work with him and to witness his creativity, commitment and industriousness first hand. The rigor of his research on the economics of poverty and nutrition and the relevance of his work to the practical concerns of development practitioners and policymakers has distinguished Erik's scholarship from most others'. It is a great honor to contribute some reflections on the economics of poverty traps, nutrition-related health risk and safety nets to this event in recognition of Erik's achievements and contributions to our profession and to questions such as those that follow.

This paper explores three interrelated questions that have been central to Erik's past research and his current concerns[1]: What is the etiology of chronic poverty and vulnerability? How does nutrition-related health risk affect patterns of chronic poverty and vulnerability? What are the implications for the design of development policy, especially safety net interventions? In recent years, economists have spilled much ink over both risk management and poverty analysis. Yet integration of these topics has remained distressingly limited. Most of the recent empirical development microeconomics research on risk has focused on variability in incomes or expenditures, the extent to which some portion of that variability might be uninsured among poor subpopulations, causing rejection of the neoclassical consumption smoothing hypothesis, and the means by which insurance emerges. Meanwhile, the lion's share of recent poverty analysis has focused on technical issues surrounding its measurement, on the relationship between poverty and economic growth, and on poverty dynamics. In this paper, we seek to integrate these two threads explicitly.

Recent research has begun to point toward an economic rationale – as distinct from but complementary to a purely humanitarian rationale – for safety net interventions intended to reduce exposure to significant downside risk.[2] Protection against risk – and perhaps especially against nutrition-related health risk – plays a crucial role in stimulating accumulation of productive assets and adoption of improved agricultural production technologies, and thus in sparking sustainable growth in incomes and reduction in chronic poverty. When designed and implemented well, social

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[1] See Thorbecke (2003).
[2] The papers in Dercon (forthcoming) offer perhaps the most complete evidence on and vision of this rationale.

protection in the form of safety nets can play an important role in stimulating economic growth as well as poverty reduction.

Chronic Poverty and Poverty Traps

Increased availability of longitudinal data at household and individual level is changing empirical poverty research in ways that affect our understanding of poverty. For nearly twenty years, the staple poverty metric has been the Foster-Greer-Thorbecke (1984, hereafter FGT) family of decomposable measures encompassing the headcount, poverty gap and more distributionally-sensitive measures of poverty within a population. FGT measures offer a powerful instrument for poverty analysis, albeit one restricted to only a cross-sectional view of poverty. With advances in data availability and methods, poverty researchers are increasingly moving from such static or "snapshot" views of poverty to dynamic or "video" perspectives, tracking the path followed by the poor over time. This has led to a variety of important refinements.

One important refinement arises from the crucial distinction between transitory and chronic poverty (Grootaert et al. 1996, Baulch and Hoddinott 2000). The basic concept of chronic poverty is clear – poverty that persists for years, if not lifetimes – even if there is some variation across authors in operationalization of the concept, sometimes as mean income or expenditures below the poverty line over a time series, sometimes as all or a super-majority of observations below the poverty line. Whatever the precise definition one applies to the data, transitory poverty is plainly shorter-lived than chronic poverty. All else equal, a poor person would far rather experience transitory poverty rather than chronic poverty.

This reveals another dimension – besides familiar FGT headcount and poverty gap measures – in which the poverty of developing countries of the South differs qualitatively from that of the wealthy countries of the North. In contrast to the United States, where the median time in poverty is 4.5 months (Naifeh, 1998), the median time in poverty in rural Bangladesh, Congo, Ethiopia, Kenya or Madagascar is one or more lifetimes. Back-of-the-envelope calculations implied by published data suggest monthly exit rates from poverty of 6.9 percent for the United States, meaning nearly 7 percent of those who are poor at the beginning of a month will exit poverty by the start of the next month. By contrast, equivalent exit rate estimates based on published panel data studies are only 1.3 percent in Côte d'Ivoire and only 0.7 percent for KwaZulu Natal state in

South Africa. Panel data sets we have been assembling in recent years indicate exit rates from poverty that are merely 0.6 and 0.4 percent in rural Madagascar and rural Kenya, respectively.[3] Although these comparisons are necessarily crude, they nonetheless underscore an important qualitative point. It is not just the *magnitude* of poverty but, perhaps even more importantly, the *duration* of poverty that differentiates much of the developing world from the United States and other wealthy countries. Poverty that persists for such long periods of time gives particular salience to the concept of a *poverty trap*, on which we reflect more momentarily.

The second important recent refinement one finds in the literature is a parallel distinction of *structural* poverty from *stochastic* poverty. According to Carter and May (1999), the structurally poor lack asset endowments sufficient to generate expected income or expenditures above the poverty line, although observed income may exceed the poverty line due to random shocks. The stochastically poor, by contrast, have observed income or expenditures below the poverty line even though their asset holdings suffice, in expectation, for them to be nonpoor. This structural-stochastic distinction introduces an all-important mapping from income or expenditure measures to asset measures which can be subject to less measurement error (Sahn and Stifel 2000) and which lend themselves to thinking about poverty dynamics as they relate to asset dynamics, which underpin the concept of poverty traps.

Consider the following stylized examples, drawn from the pastoral setting in the arid and semi-arid lands of east Africa on which we will focus later in this chapter. A structurally and chronically poor household might have no livestock or other wealth. It survives by combining low return firewood gathering with transfers from others. By contrast, a stochastically and chronically poor household might have a large enough herd to be non-poor, but has suffered from a "string of bad luck" as its female camels repeatedly failing to conceive or if they conceive, they spontaneously abort, thus

[3] We can derive a back-of-the-envelope estimate of the monthly exit rate using the simple equation Poverty $\text{rate}_t = (1\text{- exit rate})^t$ poverty rate_0, where t reflects the number of months since the initial observation. With only two data points, estimation of the exit rate is merely an arithmetic computation with zero degrees of freedom. With more data, one can estimate the poverty rate econometrically by taking logarithms of both sides and applying ordinary least squares, imposing a zero intercept condition. One should be careful about extrapolating beyond the horizon of the sample using this method because it imposes a very simple parametric structure. For example, it does not accommodate rapid dampening of exit rates as time passes. The reported back-of-the-envelope calculations are based on transition matrices reported in Grootaert and Kanbur (1993) for Côte d'Ivoire (with a poverty line equivalent to $1.12/day per capita), Naifeh (1998) for the United States (with a poverty line equivalent to $15.05/day per capita), and Carter and May (1999) for South Africa (with a poverty line equivalent to $2.23/day per capita). The Madagascar data reflect five-year panel data from sites in the central and southern highlands (Vakinankaratra and Fianarantsoa, respectively, with a poverty line equivalent to $0.50/day per capita). The northern Kenya data reflect quarterly data over two years from six sites (with a poverty line equivalent to $0.50/day per capita).

generating neither calves nor milk. A structurally and transitorily poor household might possess a herd size adequate to generate income above the poverty line only during the rainy season, but that is insufficient to escape poverty during dry seasons. Finally, a stochastically and transitorily poor household has a herd size large enough to generate adequate income, but the camel that provided the majority of the milk production this season was killed by a lion and the other camels won't give birth for another three months, leaving the household temporarily deficient. Intuition suggests strongly that these differences matter, that the longer the duration of poverty one experiences and the greater the likelihood of experiencing poverty one faces conditional on the stock of productive assets one controls, the lower a household's well being, ceteris paribus.

The structural-stochastic poverty distinction leads naturally to the third relevant recent refinement in the economics of poverty: measurement of household vulnerability to poverty. The crucial insight of this emerging literature is that substantial vulnerability to poverty does not imply that people necessarily suffer poverty, just that they face real and costly risk, and that they likely behave accordingly. Studies adopting this approach develop vulnerability measures of households' probability of being poor in one period based on observable household characteristics in one or more prior periods (Christiansen and Boisvert 2000, Pritchett et al. 2000, Chaudhuri 2001, Christiansen and Subbarao 2001, Chaudhuri et al. 2002), perhaps augmented by valuation of the risk to which the household is exposed (Ligon and Schechter 2002). Vulnerability measures thus incorporate conditional moments beyond the mean, establishing the conditional probability of falling below a poverty line, the cost of uncertain welfare, or both. In terms of our pastoral example above, of two households with identical expected incomes, one holding camels and the other holding cattle that exhibit more variable productivity than camels, the latter would have a higher probability of being poor in the future and thus would have a higher vulnerability measure.

Chronic and structural poverty or chronic vulnerability to poverty raise the prospect of *poverty traps.* The pivotal feature of poverty traps is the existence of one or more critical wealth thresholds that people have a difficult time crossing from below. Above the threshold, growth takes people toward a high-productivity steady state where they are non-poor and, at most, only moderately vulnerable to poverty, while below the threshold, people sink toward a low-productivity poverty trap characterized by frequent, if not constant, spells of poverty and high vulnerability to being poor in the future from which escape is difficult. The threshold is the point at which expected path dynamics bifurcate, i.e., where the time derivate of expected wealth changes sign. Poverty traps thus imply the existence of multiple dynamic equilibria.

Longstanding hypotheses about multiple dynamic equilibria are receiving renewed attention in the economics literature.[4] Highly suggestive empirical evidence is now emerging that indeed Myrdal, Nurkse, Rosenstein-Rodan and Young may have been correct about the existence of distinct accumulation trajectories, one or more of which lead to what we have termed poverty traps.[5] Further theoretical and empirical findings on the causes and consequences of multiple dynamic equilibria and their relationship to poverty traps offers the potential for improved development policy to diminish the prevalence of such traps In particular, empirical corroboration of the existence of poverty traps -- bifurcations in expected asset accumulation patterns as reflected in thresholds defined on current period asset holdings – would signal the necessity of renewed activism by donors and governments to address insufficiency of asset holdings and financial markets access among the chronic poor.

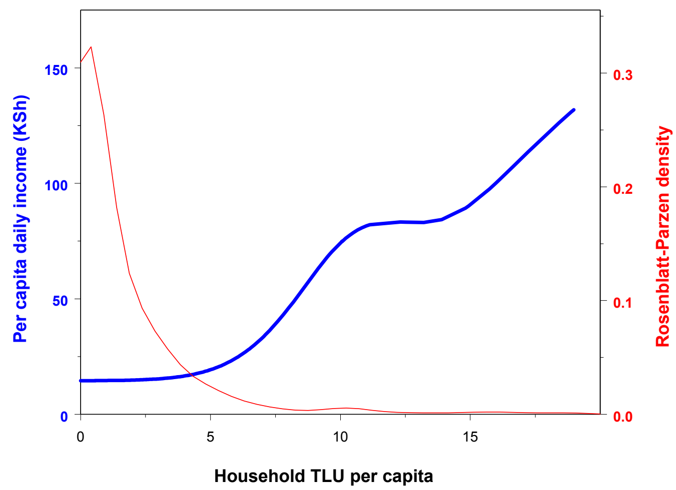
The idea of poverty traps and multiple dynamic equilibria ultimately hinges on initial conditions, in particular on the stock of productive assets one possesses and the productivity of those assets. Asset poverty thus plays a central role in understanding poverty as it is more commonly measured using income or expenditure data.

If asset holdings underpin poverty status, then asset dynamics underpin poverty dynamics. We can therefore get a reasonably good first answer to the question of "do there exist multiple dynamic equilibria associated with poverty traps?" by studying asset dynamics and looking for multiple dynamic equilibria in asset space. The central role asset holdings play in generating income and expenditure patterns, and that asset dynamics play in welfare dynamics more broadly, underscores a fundamental weakness of the canonical consumption smoothing model. The canonical version of the permanent income hypothesis, dating back to Friedman (1957), from whence predictions of consumption smoothing originate, rests on the crucial assumption that stochastic income draws are independent and identically distributed (iid) across time. That might be true if risk were purely associated with the returns on a intertemporally fixed set of assets. As soon as one allows for asset risk, however, then the iid assumption regarding stochastic income necessarily falls. If asset shocks have any persistence from one period

[4] See Loury (1981), Romer (1986), Lucas (1988), Azariadis and Drazen (1990), Banerjee and Newman (1993), Galor and Zeira (1993), Durlauf (1996), Hoff and Sen (2002) and Mookherjee and Ray (2002).
[5] See, for example, Dercon (1998), Barrett et al. (2001), Carter and May (2001) Lybbert et al. (2002), Dercon and Hoddinott (forthcoming).

to the next – for example, anything beyond very short term illness with no lasting effects –and income is a function of assets, then income draws are not iid. Rather, they will be strongly, positively autocorrelated at a minimum. More likely, the conditional distribution of income will shift over periods in response to changes in the underlying stock of productive assets. As a consequence, consumption does not follow a martingale process, rather it depends on (at least) wealth (Deaton 1992, Bhargava and Ravallion 1993). People know that and behave accordingly.

Figure 1: Income - Herd Size Relationship



We briefly explore the issue of asset dynamics among a poor population using data collected quarterly from March 2000-December 2001 among 177 pastoralist households in six sites in the arid and semi-arid lands of northern Kenya. [6] The primary nonhuman assets held by pastoralists are their herds of livestock. The relationship between herd size, measured in tropical livestock units (TLU),[7] and daily per capita income is strong and monotonically increasing, as depicted in Figure 1. Bigger herds generate a greater flow of milk, the primary source of income (in kind and cash) in the east African rangelands.[8] Interestingly, the simple bivariate nonparametric kernel regression depicted in Figure 1 suggests that per capita daily income is convex in per capita TLU holdings over most of the data range (the density of household livestock holdings is also plotted, against the righthand axis). This corroborates prior conjectures of endogenously increasing rates of expected return on assets (McPeak and Barrett

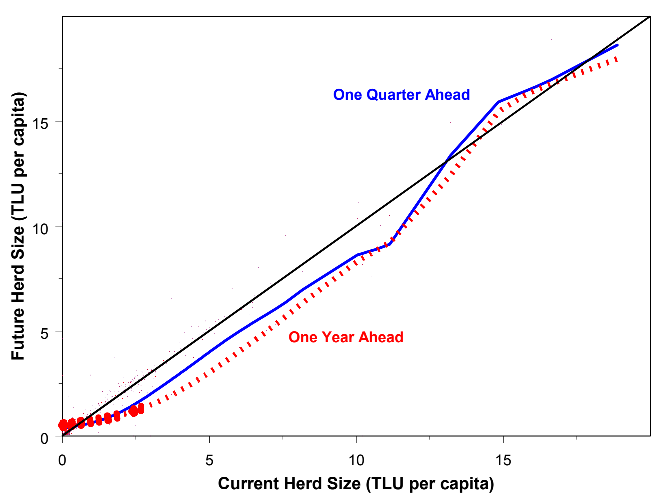
[6] The survey methods and data are described in detail in (Add codebook citation)

[7] Tropical livestock units (TLU) standardize animals by species mean live weight, permitting aggregation across species and thus herd size comparisons across agroecologically dissimilar areas between which prevailing species herd composition vary. The standard weighting system, used here, is 1 TLU= 1 cattle = 0.7 camels = 10 goats = 11 sheep.

[8] Expenditures follow a similarly shaped pattern, so this result is not specific to the welfare indicator used.

2001). While this merits further exploration controlling for additional covariates, this finding suggests that income may increase at more than a one-for-one rate as wealth increases, at least over the upper portion of the wealth distribution. Indeed, the points at which expected change in income seems to increase with additional livestock holdings correspond reasonably well with rules of thumb common in the multidisciplinary literature on pastoralism, which points to a mobility threshold of 4-5 TLU/person below which households are typically unable to engage in long-distance trekking to take advantage of spatiotemporal variability in forage and water availability, and an invulnerability-to-immobility threshold at 9-12 TLU per capita. This interval corresponds precisely with the primary range of apparent convexity in the income-herd size relationship shown. Of course, relatively few households are able to take advantage of this.

Figure 2: Herd Dynamics in Northern Kenya



The strong, seemingly convex relationship between assets and income raises a natural question about asset dynamics: who can expect to enjoy growth in herd sizes and thus even more rapid growth in incomes? Figure 2 offers an example of asset dynamics characterized by multiple equilibria in our Kenyan data. The black 45-degree line in Figure 2 represents dynamic equilibria, where expected future herd size equals current herd size. Observations that lie above the 45-degree line indicate growth in asset stock over time; observations below it reflect asset decumulation. Most households cluster around the 45-degree line, enjoying a stable herd size in both one quarter (blue solid line) and one year (red dashed line) transitions. Consequently, the conditional median (not shown) – as distinct from the conditional means depicted in the solid lines – tracks the 45-degree line through most of the data. But herd collapse is far more common than rapid herd growth, as reflected in the noticeably greater density of points below the 45-degree line than above it. The herd collapse recorded in the data largely reflects livestock losses that occurred during the first half of the study period due to a widespread drought in northern Kenya. Importantly, the results suggest an asymmetry in asset risk. The asymmetry in asset risk is illustrated by the expected herd dynamics, which show a clear S-shaped pattern, based on the nonparametric kernel regression of future herd size on current period herd size at both 3-month (quarter) and 12-month (year) leads. This pattern is very similar to that Lybbert et al. (forthcoming) find using 17-year herd histories from a qualitatively similar system in neighboring southern Ethiopia.

These asset dynamics reveal multiple dynamic equilibria. Stable equilibria appear at approximately 1 and 17-18 TLU per capita, with an unstable equilibrium around 12-13 TLU per capita, a bit above – although not statistically significantly different from – the 9-12 TLU/person invulnerability-to-immobility threshold mentioned earlier. The unstable equilibrium reflects a critical threshold. Herd sizes that reach or exceed the threshold will, on average, grow to the higher, stable equilibrium herd size, which yields expected per capita daily income of roughly US$1.50/day (see Figure 1). But only about one percent of our sample attains this high-level equilibrium. When herd sizes fall below the threshold level of 12-14 head, future per capita herd sizes steadily decrease in expectation, to the point where per capita herd sizes and expected daily per capita income are only about 1 TLU and $0.25, respectively. The herd size distribution reflected in Figure 1 suggests that few northern Kenyan pastoralists are able to surmount that critical threshold to reach the high, stable dynamic equilibrium. Instead, most people find themselves trapped in extreme poverty.

People can be trapped either because they are born into extreme poverty and have a difficult time accumulating assets or because they suffer significant shocks that cast them below the critical threshold point before they are able to accumulate enough of a herd to cross the threshold, as in Dercon (1998). Because stochastic asset shocks play a central role in understanding why pastoralists routinely suffer accumulation failures, asset risk is central to a solid understanding of poverty dynamics in an environment such as northern Kenya, where frequent droughts, violent cattle raids and human disease epidemics confront pastoralists with extraordinarily great risk of asset loss (McPeak and Barrett 2001, Smith et al. 2001).

Human Capital, Subsistence Constraints and Poverty Traps

The preceding discussion and evidence help to illustrate the concepts of poverty traps and of critical thresholds in asset space, with a specific application to livestock, the primary non-human asset of east African pastoralists. This same intuition regarding the monotone (and potentially convex) relation between assets and flow measures of welfare (e.g., expenditures or income) and the possible existence of S-shaped asset dynamics carries over to other key productive assets.

The assets of perhaps greatest relevance to poverty analysis are those embodied in people: human capital. In this section we therefore reflect on how human capital as represented by health status can be viewed as another asset that can be used to conceptualize what distinguishes the poor from the non-poor. We focus especially on how health risk, especially nutrition-related health risk that threatens human capital, can affect accumulation and risk management patterns and can lead households into a poverty trap.

No asset risk more threatens human livelihoods than health risk for the simple reason that human capital is the most valuable asset among the poor, for at least two reasons. First, the poor commonly own little other than their labor power, lacking land, livestock, and significant financial or physical assets. Their livelihoods depend almost entirely on wage earnings and transfers. Physical capacity to work underpins their livelihoods. Hence the importance of good health and nutrition, quite apart from their intrinsic value.

The second reason for human capital's inordinate importance arises from its complementarity with other productive assets. Few assets yield returns without some complementary input of labor. Even the most fertile soils yield no crops without planting and harvest labor and the most productive livestock give no milk without labor. Hence the notion of Lockean property rights, that by mixing one's labor with land (or any other latent but previously unexploited resource), it transforms the resource into a productive asset. When human capital is diminished by health or nutrition shocks, the poor's livelihood systems are at least threatened, and commonly degraded.

Furthermore, the risk associated with human capital also differs somewhat from other asset risk in that human capital is among the only assets subject to important irreversibilities.[9] A household can lose its herd or its land and yet remain able to

[9] See Gersovitz (1983), Dasgupta (1993, 1997), Glomm and Palumbo (1993), Dasgupta (1997), Chavas (2000), Barrett (2002) and Zimmerman and Carter (2003) for richer discussions of the problems associated

reconstitute a herd or secure access to new land in time. But while many health shocks are mild and quickly overcome in time, similar recovery of human capital losses is often impossible in the wake of permanent physical disability or acute illness (e.g., blindness, accidental loss of limbs or brain damage, cretinism due to iodine deficiency), much less death. The irreversibility of some types of health shocks creates an especially salient critical threshold in asset space – akin to a subsistence constraint – that has a profound effect on welfare dynamics. Future asset stocks and income flows may depend on current consumption, at least for certain populations near critical morbidity or mortality thresholds.

Although most of the risk management literature has focused on income risk and the use of asset stocks to buffer consumption against stochastic income, an important subliterature addresses the somewhat more complex problems associated with asset risk among poor populations (Dercon 1998, Carter and May 2001, Zimmerman and Carter 2003, McPeak 2004, Lybbert et al. forthcoming). Economists have long appreciated that asset risk influences consumption and accumulation patterns because future income is endogenous to current asset shocks and subsequent consumption choices (Phelps 1962, Levhari and Srinivasan 1969, Sandmo 1969, 1970). When income shocks and asset shocks occur contemporaneously (e.g., poor rainfall causes non-lactating animals to die but also causes a reduction in milk production by currently lactating animals), then forward-looking agents will balance familiar consumption smoothing behaviors associated with agents' desire to equalize the discounted expected utility of consumption across periods – taking income as given – with asset smoothing behaviors arising from an inextricable desire to smooth expected income across periods. As a consequence, household consumption over time will tend to be relatively more volatile (i.e., less smoothed) in communities where asset risk is greater.

As the coping strategies literature makes abundantly clear, very poor populations will liquidate virtually any asset – even sell themselves or their children into slavery – when they might otherwise cross beneath a critical nutritional threshold, a point where they run intolerable risk of permanent impairment due to injury or illness (sometimes referred to in the dynamics literature as an "absorbing state"). Yet the poor will also vary consumption dramatically above that threshold in an effort to protect productive assets essential to minimizing nutrition-related health risk in future periods, typically reducing food consumption as a first line of defense against long-term asset loss (Maxwell 1995,

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with undernutrition and irreversibilities (i.e., absorbing states and other forms of hysteresis) in human health dynamics and resulting intertemporally nonseparable preferences.

Barrett 2002). In sum, in the face of asset risk, the very poor may destabilize consumption – while being careful not to cross the subsistence threshold in the current period – so as to defend their productive asset stock and thereby maximize the probability of future survival.

We can return to the pastoral example to illustrate the dilemma facing poor households in the face of asset shocks. Herders near a critical herd size threshold become very reluctant to liquidate livestock to support current period consumption. They understand the potentially devastating long term implications of slipping below the livestock asset threshold. However, failure to liquidate assets can lead to a consumption crisis. This occurs because the effort to guarantee future consumption comes at the expense of current period consumption thus increasing the possibility of malnutrition-related health risks. This requires a delicate balancing act to reduce current period consumption enough to ensure livestock assets are sufficient in the future, but not so much as to jeopardize human capital sufficiency in the future. That balancing act may not be possible given the constraints faced by the poor. It can also lead to great consumption volatility among the most vulnerable subpopulations.

Consumption instability is especially worrisome among the world's poor because severe (macro- or micro-nutrient) undernutrition is strongly and causally associated with acute health shocks and because the poor depend disproportionately on labor earnings for their livelihoods. Ill health is both cause and consequence of extreme poverty. As people become poor, they become more likely to suffer serious illnesses and injuries and such illnesses and injuries aggravate pre-existing poverty. This bidirectional causality lies at the heart of the literature on nutritional efficiency wages.[10]

One source of low exit rates from poverty originates in this bidirectional causality. Over a long period of time, it can even lead to the intergenerational transmission of poverty, as parents' income is positively related to children's nutrient intake and likelihood of receiving immunizations and other preventive and curative health care, and early childhood episodes of illness and undernutrition have persistent effects on stature and cognitive development that significantly affect expected lifetime earnings (Dasgupta 1997, Strauss and Thomas 1997, Martorell 1999, Glewwe et al. 2001,

[10] Liebenstein (1957) first emphasized the economic importance of food biochemistry for labor productivity. See Dasgupta and Ray (1986, 1987), Dasgupta (1993), Ray and Streufert (1993), and Dasgupta (1997) for clear explanations of the details of the nutritional efficiency wage hypothesis and its relationship to poverty traps. Criticisms of this hypothesis include Bliss and Stern (1978), Rosenzweig (1988), and Strauss and Thomas (1995).

Hoddinott and Kinsey 2001, Gertler and Gruber 2002, Dercon and Hoddinott forthcoming) .

The fact that serious health shocks – many of which are causally related to undernutrition – cannot be fully insured and thus can have significant and persistent effects is fairly intuitive. But health and nutrition shocks matter not only because of their ex post impact when they do occur but, of broader relevance, because people adapt their livelihood strategies in response to their assessment of the risks they face under alternative strategies. As we discussed above, vulnerability to future poverty is as important to understand as current and past poverty. People optimally manage assets and consumption with an eye toward the effects on future human capital stock, not just to equalize expected utility of current consumption over time. The resulting behaviors may sometimes appear as if agents are making intertemporal resource allocation decisions subject to a subsistence constraint, i.e., as if consumption is constrained not to fall below some threshold level in any period. The term "subsistence constraint" nonetheless lends itself to misinterpretation. It is less a strict physiological constraint – human basal metabolism appears extraordinarily adaptable in terms of energy consumption, albeit not with respect to most micronutrients – than an endogenous behavioral pattern caused by the persistence of shocks to human capital, thus leading to stochastic income draws that are not independent and identically distributed across time, undercutting the standard Friedmanite model of consumption smoothing. Household decisions made in response to their perceived vulnerability to health shocks have important implications for well being over time. In particular, ex ante health and nutritional risk mitigation strategies can have a profound effect on accumulation patterns. This happens in at least two different ways.

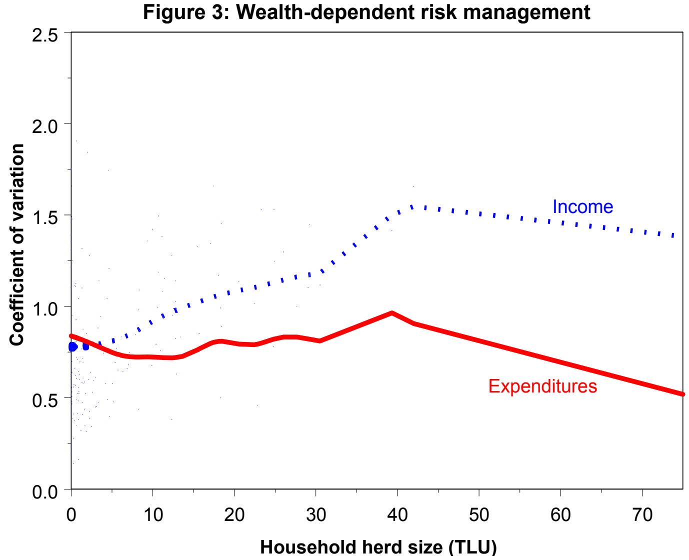
First, peoples' risk preferences affect their choice of activity and consumption patterns. If decreasing absolute risk aversion best describes risk preferences, as the bulk of the relevant literature suggests, then the poor will tend to pay more to reduce risk exposure than will the rich. Such payments typically come in the form of foregone earnings. For example, Binswanger and Rosenzweig (1993) found that a one standard deviation increase in weather risk induces Indian households of median wealth to reduce expected farm profits by an estimated 15 percent, while household in the bottom quartile reduce expected farm profits by 35 percent. The wealthiest quartile households, on the other hand, have adequate independent risk coping mechanisms, so they adjust input use patterns hardly at all to increased exogenous risk. Carter (1997) estimated household willingness to pay for certain food availability in Burkina Faso at better than twenty percent. He found that the cost of incomplete self-insurance seemed to be on the order of ten percent or more of income. Several recent studies – notably Elbers and Gunning (2003) and Wood (2003) – similarly observe that households can trap themselves in chronic poverty through their rational approach to risk management.

Second, the effects of health and nutritional risk on behavior and welfare dynamics may come not through risk preferences per se, but through awareness of and behavioral response to the existence of critical thresholds in human capital space associated with irreversibilities in physical functioning. As a direct consequence of the absorbing states associated with irreversible health shocks, the poor may forego high-return investments that would demand greater short-term sacrifices in consumption than they dare undertake for fear of coming too near the threshold of permanent (or near-permanent) health shocks. For example, Zimmerman and Carter (2003) demonstrate how uninsurable asset risk leads poor people to hold highly unproductive asset portfolios. In a similar spirit, Moser and Barrett (2003) demonstrate the importance of subsistence constraints in explaining nonadoption of a high-yielding, low-input method of rice production in Madagascar.

The presence de facto subsistence constraints associated with irreversible health shocks causes important interhousehold variation in risk management behavior. In particular, while the poor will still tend to smooth income more than the rich – due to risk averse preferences and financial barriers to entry into high return/high risk activities – they will also tend to smooth consumption less, relative to their income, than do the rich, choosing instead to buffer productive assets on which future well-being depends as a strategy for staying away from the perilous threshold of permanent impairment. The threat of irreversible human capital loss tends to induce generalized asset smoothing – as distinct from consumption smoothing – among those near subsistence thresholds, as the poor aim to protect critical resources as a bulwark against future nutrition-related health risk.

Figure 3 demonstrates this point empirically, plotting the nonparametric kernel regression of the coefficient of variation (CV) for both income and expenditures – computed from the quarterly panel data observations from our 177 northern Kenyan households – on initial period household herd size. The positive correlation between wealth and income risk is apparent in the upward slope of the blue, dashed line depicting income CV. The gap between the income CV regression line and the (red, solid) expenditure CV regression line reflects consumption smoothing behavior. While richer households take on greater income risk than poorer households do, the rich nonetheless enjoy lower intertemporal variability in expenditures. Consumption smoothing is a normal good, increasing in wealth in spite of prospectively greater absolute risk aversion among the poor. This occurs precisely because of the threat posed by nutrition-related health risk. Among the poorest households, intertemporal income variability is actually less than expenditure volatility, signaling that the most vulnerable households will destabilize consumption in order to protect crucial productive assets on which their future survival will depend.

Figure 3: Wealth-dependent risk management



In summary, the existence of critical irreversibilities in human capital dynamics — generating multiple equilibria similar to the S-shaped asset dynamics shown previously for livestock in northern Kenyan pastoralist households – affects household risk management. Because households know that health and nutrition shocks occur with positive probability that is a function of current allocation decisions and that some asset shocks are irreversible, they adapt their behaviors accordingly, choosing activity and asset portfolios that limit income risk, foregoing high-return investments that would demand significant short-term sacrifice beyond what is prudent and safe, and willingly destabilizing consumption in order to protect assets so as to minimize the probability of suffering irreversible health or nutrition shocks the next period. Beyond some threshold level of asset holdings, they can begin to afford to undertake higher risk and higher return livelihood strategies, leading to locally increasing returns to assets such as those depicted in Figure 1.

The Economic Rationale for Safety Nets

The existence of significant asset risk leads directly to the strongest economic rationale for safety nets. The fact that many shocks – especially serious health shocks, many of which are causally related to undernutrition – cannot be fully insured and thus have significant and persistent effects is fairly intuitive. This provides the prevailing humanitarian rationale for interventions, based on what is commonly termed a "rights-based approach" enshrined in the 1948 Universal Declaration of Human Rights (Article 25) and the 1966 International Covenant on Economic, Social and Cultural Rights, (Article 11) and reaffirmed at the 1996 World Food Summit and the follow-on summit held in 2001. Unmet demand for ex post recovery assistance also provides one important economic rationale for publicly-provided safety nets in the form of emergency food assistance, employment guarantee schemes, and publicly funded health care for the indigent.

We want to pursue a slightly different, supplementary tack in arguing the economic rationale for safety nets. The poor tend to be much more exposed than the rich are to asset risk and thus face a higher probability of being cast below critical thresholds due to adverse shocks caused, for example, by drought, floods, hurricanes, epidemics or war. [11] In the absence of effective safety nets, people routinely fall not only into poverty, but beyond critical asset thresholds and into chronic poverty. Effective safety net programs can generate significant indirect benefits by reducing vulnerable peoples' need to mitigate downside risk through costly portfolio management and activity choice or to sell off scarce productive assets when current earned income shortfalls are so serious that they would otherwise suffer irreversible health effects.

Development policy has long focused on structural interventions intended to increase the poor's asset holdings through direct transfers, public health and education services, land reform or other such redistributive programs. Such policies may indeed be necessary to assist many of the chronically poor (Barrett forthcoming). There exists no good evidence of which we are aware, however, as to the relative poverty reduction effectiveness of direct efforts to build up the assets of the poor through redistributive

[11] At the aggregate level, IFRCRCS (2002) reports that more than 98 percent of the people affected by different types of environmental (e.g., droughts, earthquakes, floods, avalanches) and technological (e.g., industrial or transport accidents) disasters worldwide, 1992-2001, lived in low and medium human development nations. Although airline crashes in the United States and deaths from severe heat waves in France capture the headlines, the overwhelming majority of shocks are experienced in the developing world.

transfers, as compared to indirect efforts to induce endogenous asset accumulation by the poor through reduced exposure to downside asset risk. This is an interesting and important question that rigorous, policy-oriented researchers in the Thorbecke tradition might usefully tackle.

The issues is not only the relative effectiveness of alternative types of interventions.[12] Redistributive programs may only be effective in achieving sustainable, long-term reductions in chronic poverty when complemented by safety nets. Moreover, absent effective safety nets, redistributive policies to build up the poor's asset holdings may prove rather like opening the drain on a tub with the faucet still running. Many people may exit chronic poverty due to pro-poor transfer policies, but new ones will enter chronic poverty just as quickly in the absence of effective safety nets and households teetering on the edge of chronic poverty will choose risk management strategies that predictably fail to stimulate asset and income growth. At a minimum, effective safety nets should block pathways into poverty.

Moreover, the knowledge that such safety nets exist may allow some households to move out of poverty due to behavioral changes that come about in response to reducing the risk of crossing some critical asset threshold. When financial markets fail and people cannot borrow to trade consumption between periods or contract for insurance against adverse shocks, the financial market failure gets displaced into exaggerated activity in some other area(s), causing costly allocative inefficiencies that retard asset accumulation and income growth. If safety nets can effectively truncate the lower tail of the distributions faced by households such that they no longer need to worry about a brief shock having calamitous, permanent consequences, then we should observe poor people undertaking more high-return investments that require short-term sacrifice, a reallocation of portfolios away from safer, lower-return assets and towards higher-yielding assets and activities, and reduced asset smoothing behavior. These are important, open, empirical questions as to whether safety nets can provide a pathway out of poverty for those whose endogenous risk management strategies leave them chronically poor.[13]

But safety nets can only generate desirable poverty reduction benefits if they are credible. Poor people must believe that a promised safety net will indeed be available

[12] Barrett (forthcoming) presents a simple formulation of income dynamics and draws a useful distinction between "cargo net" and "safety net" interventions intended to address different sources of intertemporal variability in welfare. The differences between alternative policies are developed in more detail there.
[13] It is also critically important to identify and mitigate any adverse incentives that may result from the implementation of such safety nets.

when needed and that it will function as promised. Otherwise, they will not reduce their practice of costly risk mitigation strategies that contribute to chronic poverty.

The crucial issue here is targeting. Targeting concerns the who, the when, the what and the how questions surrounding transfers: is aid reaching people who need it (and not flowing to people who do not need it), when they need it, in appropriate form, and through effective modalities. All real world transfer programs suffer targeting errors for the simple reasons that (i) information is costly to collect and to process, (ii) it is impossible to have perfect information about all people at all times (i.e., to know who is and is not needy) and (iii) actual allocations are made for multiple reasons, only one of which is objective need (Barrett and Maxwell forthcoming). Especially where means-based screening of prospective beneficiaries proves administratively infeasible – as is true in most low-income countries – then intra-community heterogeneity and factor market failures tend to generate significant errors of inclusion even in self-targeting program designs (Barrett and Clay 2003). Because a safety net program without targeting errors is practically infeasible, there exists a difficult tradeoff between wasteful and distortionary errors of inclusion and potentially damaging errors of exclusion. There's no clearly superior direction in which to err. The difficulty of this tradeoff makes minimization of targeting errors essential (Barrett and Maxwell forthcoming)

In the northern Kenyan communities we study, food aid provides the primary (in many cases, the only) safety net. In northern Kenya, food aid responds to rainfall shocks. When period-average rainfall across a large area drops, food aid shipments begin. So food aid responds to climate shocks. While rainfall indeed has a major effect on asset and welfare dynamics in the rangelands of the Horn of Africa, the effects are more subtle than is commonly acknowledged. First, there is considerable microclimatic variability. Some areas may get just enough rain at just the right time that they suffer no serious loss of water or forage during a "drought". Relief agencies commonly fail to take such microvariability into consideration in geographic targeting of food aid. Second, agents vary markedly in their capacity to manage common rainfall shocks – either ex ante, through mitigation efforts, or ex post through coping strategies – and thus asset risk appears to be overwhelming idiosyncratic (i.e., household-specific) rather than covariate (McPeak and Barrett 2001, Smith et al. 2001, Lybbert et al. forthcoming). Because asset dynamics are less closely correlated across households than is often assumed, safety net interventions such as food aid distribution that respond to aggregate shocks necessarily introduce considerable errors of both exclusion (e.g., leaving out people suffering serious shocks outside of drought periods) and inclusion, as depicted clearly in Figure 4. Third, when aggregate shocks do cause asset loss due, for example, to herd die-offs, the income shock is persistent, dampening only if and as herds recover. But for the nontrivial minority who lose their herds completely, or who suddenly fall below the critical mobility threshold, the shock may be nonstationary, in which case food aid as a short-term palliative fails to match the long-term needs for an alternative livelihood.

It is useful for the moment to return to the original stylized discussion used to illustrate different definitions of poverty. Food aid provides temporary assistance to the chronically and structurally poor household that had no animals, but offers nothing in the way of a safety net to prevent falling into poverty or an escape route from poverty for this group. For a chronically but only stochastically household, food aid may provide some temporary assistance that helps ride out the string of bad luck that the household is suffering, but does little to either prevent or address the situation, and only helps if the food aid that is triggered by a covariate crisis happens to fall in the same periods as the run of bad luck experienced at the household level. A household that is structurally and transitorily poor may find food aid helps them from falling from seasonally into chronic poverty, but will still require assistance in their effort to escape structural poverty. The group most clearly helped by a food aid program is the stochastically and transitorily poor – the rainfall crisis is a stochastic event, and the goal of food aid is to allow these households to ride out the food availability crisis without having to draw on their asset base (both livestock capital and human capital) in ways which will push them across some critical threshold.

In our sample, every household received food aid in at least one quarter, 2000-2001, a period beginning in the midst of one of the worst droughts to hit the region in a generation.[14] Yet in spite of ubiquitous participation and a severe drought, the median share of total household income represented by food aid was merely 0.7% and only 1.0% of households received at least 10.0% of total household income in the form of food aid.

[14] For example, in our three most arid sites (Kargi, Logologo and North Horr, respectively), cumulative rainfall between May 1999 and September 2000 was only 38-63 millimeters. The other three, semi-arid sites (Dirib Gombo, N'gambo and Suguta Marmar) had significantly higher total precipitation, but still well below annual or seasonal averages.

Figure 4: Food Aid Targeting in Northern Kenya

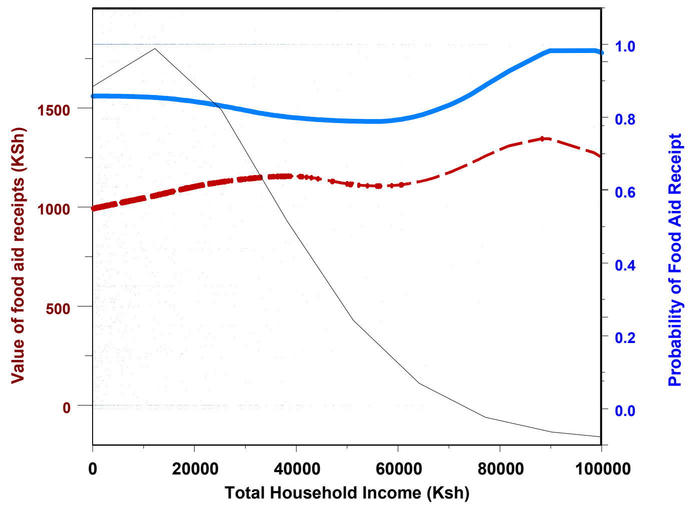


Figure 4 shows the nonparametric kernel regressions of the probability of receiving food aid (blue thicker quasi-horizontal line) and of the monetary value of food aid receipts (red, thinner quasi-horizontal line) on household earned income[15] over a three-month period, as well as the density of household earned income (black, thinner curve). There was no appreciable difference across the income distribution in either the likelihood of receiving food aid in a given quarter nor of the value received. If anything, households with very high earned income were more likely than those with low earned incomes to receive food aid and their expected food aid receipts were somewhat higher than those received by the poorest households. These findings echo evidence reported recently from Ethiopia that similarly show food aid going to the rich with at least the same frequency and at nearly the same rate as to the poor (Clay et al. 1999, Jayne et al. 2001). In spite of massive shipments into the region and widespread concerns that pastoralists suffer food aid "dependency", the resource is distributed "a mile wide and an inch deep", as one NGO official described it to us recently, so broadly as to become ineffective in truncating downside risk faced by pastoralists. As a consequence, the safety net fails to provide necessary insurance against downside risk and pastoralists engage in costly self-insurance through herd overstocking, restricted mobility, etc. (McPeak and Barrett 2001, Lybbert et al. forthcoming).

[15] The conditioning variable here is earned income (that is, excluding transfers). By way of reference, median quarterly income is just over KSh8700, the top quintile had quarterly income of KSh23500 or greater and the top five percent earned KSh50000 or more.

Conceptually, safety nets can play an extremely valuable role in mitigating asset risk, in keeping short-term shocks from leading to chronic poverty through endogenous asset decumulation or low-return production and portfolio strategies. There are examples of safety net schemes that seem to work, perhaps especially those based on public employment guarantees.[16] But as presently designed and implemented, food aid based safety nets appear largely ineffective in either preventing people from falling into poverty traps or at lifting people out of poverty traps in places like northern Kenya. In addition, the amount of aid delivered does not appear to be particularly credible as a means to induce behavioral change that will help households grow themselves out of extreme poverty. Food aid may indeed contribute to better consumption outcomes and anthropometric status (Dercon and Krishnan 2003, Quisumbing 2003), but it largely fails to help move recipients out of chronic poverty.

Conclusions

In this chapter we have tried to outline the integration of risk management and poverty reduction issues, focusing especially on how the experience of and exposure to asset risk may trap certain households in chronic poverty and vulnerability. If there exist multiple dynamic equilibria of the sort conjectured by classical development theorists such as Myrdal, Nurkse, Rosenstein-Rodan and Young, then even minor perturbations to individual asset stocks and the prospect of significant, if transitory, income shortfalls can both have lasting welfare effects on subpopulations with limited initial endowments and scant or no access to credit and insurance. Drawing on original, high-frequency panel data from very poor pastoralist communities in northern Kenya, we find suggestive evidence both of multiple dynamic equilibria consistent with the hypothesis of poverty traps and of risk management patterns consistent with the notion that risk exposure and experience may play a significant role in trapping such populations in chronic poverty and vulnerability.

The normative prescriptions of minimalist neoclassical models generally fail in the presence of risk and uncertainty, especially where insurance market failures are compounded by credit market failures, so that people are unable to move consumption across periods in response to transitory shocks to assets or incomes, and where

[16] See Ravallion (1991, 1999), Ravallion et al. (1993), Besley and Coate (1992) and von Braun (1995) for detailed descriptions of the theory and evidence on public employment guarantee (“workfare”) schemes.

important irreversibilities break down intertemporal separability, thereby affecting risk management and asset and welfare dynamics. As a consequence, there exists a real public role in risk management for the poor (Ahmad et al. 1991, Dercon forthcoming).

Credible and ubiquitous safety nets can both (i) respect the human right to food and (ii) reduce downside risk, thereby inducing portfolio reallocation, raising the real prospect of income growth through capital accumulation and new technology adoption and market participation. In theory, effective safety nets can enlarge the basin of attraction toward higher dynamic equilibria and reduced vulnerability. For most of the poor, the key safety net lies in nutrition and health space because their most important irreversible asset is their human capital. The need for high frequency consumption to maintain health can necessitate asset divestiture in the face of sharp, transitory income shocks, causing short-lived shocks to have persistent, if not irreversible, effects. Moreover, awareness of crucial thresholds affects risk management, causing the poor to choose low-return production strategies and asset portfolios that merely reinforce their chronic poverty and vulnerability. Unfortunately, the record of safety net provision has been checkered, so we have limited empirical evidence as to how effective in practice safety nets can be in inducing the poor to choose higher-return livelihood strategies. This is an area ripe for intensive research.

New research in this area will need to take seriously, however, the centrality of asset risk – not just income risk – to chronic poverty and vulnerability. In particular, researchers need to start thinking about vulnerability relative to critical thresholds, not only relative to (inherently arbitrary) poverty lines. There's great inertia behind the use of poverty lines, but this doesn't seem like the most fruitful way to proceed. We need to begin establishing whether critical thresholds indeed exist and, if they do, to identify them with sufficient precision so that we can locate the appropriate level and trigger for safety nets. Because the key vulnerability is less with respect to a poverty line (although that is certainly important and informative) than with respect to the points at which welfare dynamics birfucate, research needs to focus on increasingly on these dynamics and on how to implement effective, credible safety nets to keep people from falling into chronic poverty.

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